TRANSACTIONS.

In response to the generally expressed wish of the members of the Academy, the Executive Committee called the seventeenth annual meeting at Lawrence, on November 24th, 25th, and 26th, 1884, the sessions being held at the University. The following abstract of the proceedings includes the business transactions of general interest, and the papers read at the sessions, so far as furnished for publication by their authors and accepted by the Committee on Publication.

The proceedings of the afternoon of the 24th were of a general business nature, including the annual reports of the officers of the Academy and the appointment of temporary committees.

At the evening session the annual address of the President was delivered by Dr. Brown, as follows:

IS A GEOLOGICAL SURVEY OF THE STATE A NECESSITY?

In accordance with the custom and rule of this Academy, the President is required to deliver an address at each annual meeting, on some subject pertaining to the work of the past year, or on the advancement and progress of science in our midst. In response to this, the work and labor of the members of the Academy will be presented to you during the meeting, as they have come fully prepared with papers of great value and interest, covering all branches of science, with new discoveries and new developments in every department. Time, labor and money have been expended by them to bring together so much original investigation and research, that will be appreciated by scientists everywhere, and by the people of our State.

We will devote the remainder of the evening to something we deem of vital importance to our State. That is, the question of a geological survey of Kansas. If we can convince you, and through you the great mass of our citizens, that there is a necessity that such a work should be made, and that the benefits derived from it will be one hundred fold of the cost attending the same, our labor in bringing this subject before you will not be without some good results.

This Academy was organized for the advancement and promotion of scientific knowledge. In pursuit of it, many facts in regard to the resources of the State have been made public, which have proved of value to the people of this commonwealth. Take, for instance, the weather reports of Profs. Snow and Lovewell, which have been furnished to the public; the botany of the State, by Prof. Carruth; the geological formations, by the late Prof. Mudge; besides mineral deposits, insect life, etc., by the members of the Academy.

We know very little in regard to our mineral wealth. The digging of a well has developed coal, opened up lead-mines, brought forth mineral waters, and unearthed hidden treasures. If the State should take hold of a geological survey and prosecute it faithfully, the public would find that Kansas possesses within her limits, valuable resources which now lie idle and unknown. What is there in a geological survey that the farmer, merchant and mechanic should lend his aid and influence in securing an appro-

priation for this purpose? He might say, if coal was found in his vicinity in great abundance, it would reduce the price. If the rainfall could be regulated, so they could get it when needed; if frost would only come in winter; if grasshoppers could be kept away; if all the various insects that prove so destructive to fruit and grain could be rendered harmless, a geological survey would be a good thing. We all agree to this, and believe a great deal may be accomplished in benefiting the public that they do not know of now, and much more to the development of the State.

A bill was introduced during the last meeting of the Legislature, asking for a small appropriation for a geological survey. A large number of the members thought it a good thing, but the railroad bill should pass first. Others said it cost too much — can't afford it. Others asked, What is the use of a geological survey? Another answered the question by saying, A geological survey is to pay expenses of someone for collecting old bones and minerals that are found scattered over the prairies. These are some of the objections to a geological survey, showing that the purpose and object is not generally known. Some think it is merely a topographical survey, that refers to the surface entirely and has little or nothing to do with anything that is found below the surface. From the various opinions that people have in regard to it, we believe that a great many do not understand what a geological survey is, or the benefits derived from it. If properly understood, we believe there would be no difficulty in securing an appropriation for the work.

We shall endeavor briefly to state what a geological survey is, and some of the advantages of it. It comprises the study of everything below the surface, where the most valuable part of the earth may be found — boring and digging into the crust of the earth to any depth that may be necessary to develop everything that may be of value. Should coal be found, all information in regard to the area, depth, thickness of vein, character and value for heating purposes, and probable cost of mining the same, would be fully noted. Location of lead and other minerals, the districts in which they may be found, their depth, and all other information that may prove of value. Clays of various kinds for the manufacturing of pottery, tiling, brick, etc. Chalk, limestone, sandstone, gypsum and other materials used for building purposes. Zinc, bismuth, arsenic, strontia and other materials used in the arts; the cost of mining the same, and their commercial value. Also, the botany of the State, showing the distribution of the timber and vegetable growth indigenous to the State. Water power on all the rivers and streams, and the fall from various points, with such information as will enable every one to understand their availability as water power for manufacturing purposes. An analysis of all the mineral waters, gas wells, their extent and value, the practicability of using the gas for fuel and lighting purposes. An examination of the character of the soil from all the counties in the State, with an analysis of the same, indicating the soil suitable for the growth of various agricultural productions, in such a way as to be of practical benefit to the farmer. Rainfall and temperature should be accurately obtained. Considerable attention would be given to the eradication and means of the destruction of insects that are injurious to fruit and fruit trees, and prey on the products of the soil; these and many other things will be developed that will prove a benefit to our people, and of immense value to the State. County maps should be made, giving a full history of the resources of the county, describing accurately the depth, location and character of all coal deposits, clays, building stones, soils, water power, and all information that would be of value to the counties, and cost of utilizing the same. Publishing maps for the counties, supplying the people with the reports of the survey, and disseminating information during the progress of the work. All these come within the range of a geological survey, and properly belong to it.

To do this work, an expenditure of money will be necessary; less than $100,000 dur-

ing the next ten years will be sufficient to cover the expenses of it. In return for this outlay, we cannot estimate in dollars and cents the value to the State. We have the evidence of the most prosperous States where surveys have been made, that it has been of untold value to them. It is a work of great importance, benefiting all the citizens alike, bringing prosperity, building up and developing the State and publishing the advantages that we possess, now hidden from view; saving thousands of dollars to people who without any knowledge of what we have, engage in enterprises that may or may not be a success. The useless waste of money would be prevented. With a geological survey, almost a certainty in regard to success would be secured.

If you want to mine for coal, you will know where the depth and quality can be found; if for lead, zinc and other metals, reference to the geological survey will tell you; questions as to mineral waters, building materials, etc., will be fully answered. At the present time, there is considerable interest manifested in regard to the sinking of artesian wells in the western part of the State, which cannot be done until a geological survey has been made, and to delay now would be hindering the growth and development of our State. We believe it would be for our best interests.

In order to get the experience of other States that have had geological surveys, I mailed to the Secretary of each of the States in the Union a number of questions, as follows:

Has a geological survey of your State been made?

If so, when was first appropriation, and what amount?

Has appropriation been made each year since?

How much have been the total appropriations?

What practical benefit have the people derived from it?

Mention some of the industries that are in operation which have derived their origin and success from the geological survey.

Any other information that you may have that will aid us, please give.

Replies have been received from twenty-nine States. Those not heard from belong to extreme South and new States in the West. We received the following, which I will read to you in regular order:

MAINE.

The State of Maine has had no geological survey since 1861, and then it was but a partial survey, under the direction of the Board of Agriculture. A similar survey, under the same direction, was made in 1839. The reports made at that time have been exhausted.

NEW HAMPSHIRE.

A statement received in reply to inquiry of March 10th, 1884, shows that a geological survey of the State of New Hampshire has been made, and June 24th, 1839, there was an appropriation of $2,000 to carry on the work of surveying; this amount was to be paid annually for three years. The total appropriations have been upwards of $60,000.

A full history of the geological survey of this State can be found by referring to vol. 1, Geology of New Hampshire, by Hitchcock, (Concord, Edward Jenks, State Printer,) 1874, in our State Library.

VERMONT.

Vermont has had a geological survey. The first appropriation was made in or about 1830; they then appropriated $2,500 a year. In answer to the question concerning the benefit this survey has been to the people, the report says: Our marble and granite interests have been promoted extensively. We have now extensive quarries, employing thousands of men, which before were unsuccessful, and much money was lost, as the lay of the limestone had not been determined, and work was a subject of guess.

RHODE ISLAND.

In 1839 and 1840 a geological survey of the State of Rhode Island was made. At the January session of the General Assembly, in 1839, they appropriated $2,000 to the advancement of the survey. There has been no subsequent appropriation: making the total amount of appropriations only $2,000.

The Secretary of State in his report further states, that owing to the lapse of time since the survey was made, he is unable to state what benefit the people have derived from it. He also adds that it was evidently deemed important when the survey was made, as he finds that the Rhode Island Society for the Encouragement of Domestic Industry, at a meeting held December 28th, 1838, voted to appropriate $500 in aid of the survey, provided, however, the State should appropriate the residue. At the January session of 1875 a commission was appointed to prepare a plan for a geological survey of the State. They made a report, but no further action was taken. Five hundred dollars was appropriated for the purpose.

CONNECTICUT.

Communications from Connecticut report that there has never been any geological survey of their State made.

NEW YORK.

Professor John Hall, State Geologist of New York, makes the following statement in reply to our inquiries, referring to the questions in the order of one, two, three, four and five, as marked in the margin:

1. A geological survey of the State has been made.

2. In 1836 an appropriation was made of $104,000, to cover the salaries of a geologist, a botanist, a mineralogist and four geologists, with their assistants, together with the current expenses of the field-work for four years.

3. The appropriations made since that time have been chiefly for the publication of the natural history of the State, including botany, zoölogy, mineralogy, geology, paleontology, and agriculture. These appropriations have not always been made annually, though expenses have been annually incurred. The expenses have been for publication and for the salaries of those engaged in the work. The publications embrace the quarto volumes of natural history, and the reports (octavo) of the State cabinet and State museum.

4. The total of appropriations, including that of 1836, together with the appropriations for the publications of the natural history, the establishment and support of the State museum, and the publication of its reports for thirty-six years; also the publication of the natural history of the State, a highly-illustrated work, which now numbers over twenty bound volumes of 3,000 copies each, making in all 75,000 quarto volumes, which have been distributed to the people of the State of New York.

5. Among many other things, great practical benefits have arisen from the fact that the limits of the vein-bearing formation in the State have been pointed out in the several geological groups, and their areas delineated upon the maps. This knowledge has encouraged the application of intelligent industry to their development, and their production is an immense source of profit to those engaged in the work.

The limits of the true salt-bearing formations are shown upon the maps, and the original suggestion, that the source of the brine spring was in the solution of rock salt in the undisturbed strata, has been verified. The working of this product has of late become an important industry, which is likely to be extended in the near future.

Formerly, much time and money were wasted in fruitless endeavors of borings for brines in the lower formations which the geological survey has shown to be barren of such mineral products, or to contain small quantities of very impure brine, with no source of considerable supply. The investigation and publications of the survey have

given confidence in this decision, and there is no longer waste of time or capital in such work.

In the same connection, the limits and extent of the water-line groups have been determined, and this has given rise to a very extensive and profitable industry at localities along almost the entire length of the State—from the Hudson to the Niagara river.

The sources of durable building stones have been indicated by the determination of the limits of certain geological formations.

The search for coal in the block states, in the Hudson valley and localities in the interior of the State, formerly a prolific source of expenditure and disappointment, has ceased among all intelligent men since the relations of the true coal formations to the rocks of New York were determined by the geological survey. Much time and money were formerly expended in fruitless undertakings for the mining of coal. Since the settlement of the State it has been estimated that more money has been spent in this than in the entire cost of the geological survey and its publications.

I may perhaps be allowed to conclude this short statement of the benefits of the survey, by quoting some paragraphs from a report made to the Committee on Public Education of the New York Assembly in 1870:

"In the estimates of the products of the geological survey there is one element that cannot be given in figures—this is the knowledge which is the result of the survey, and which, if not everywhere evidenced in positive action, can in some degree be estimated by its negative effects. Intelligent people can no longer be found to form companies and expend thousands of dollars in the Hudson or Mohawk valleys, or in the southern tier of counties, in search for coal in the block states. People no longer bore wells in the Medina sandstone in search of productive brines, nor look in the Catskill mountains for granite.

"The limits of our great iron-bearing formations are well defined and fully understood by all intelligent men, and neither iron ore, lead or silver are sought as formerly in the broad agricultural belts south of the great limestone terrace. There is a general confidence in the result of the survey, coming from the conclusion that science has given fixed views and opinions which no assertion of empiricism can set aside.

"Before the completion of the geological survey of the State of New York, there was not a single text-book upon geology for the use of our schools. The many thousands of copies now in use, all teaching the same facts, attest the value of the geological survey.

"If the treasurer of the State does not show the credit of these text-books, the authors and booksellers have profited, and the students of our educational institutions have from this source become more intelligent citizens of the commonwealth.

"The knowledge resulting from the geological survey of New York, and its language and nomenclature, are everywhere recognized, and have become more intelligently incorporated into the scientific literature of our civilized people."

I might go on almost indefinitely with statements of the advantages which have resulted from the geological survey of the State of New York, but I believe I have said enough to answer the object of the inquiry.

PENNSYLVANIA.

By an act which passed the Legislature of Pennsylvania in 1874, the sum of $35,000 was thereby annually appropriated for three years to conduct a geological survey of that State. In 1876 an additional appropriation of $15,000 was made. For the year 1877 an appropriation of $50,000 was made. Again, the sum of $150,000 was appropriated. Subsequently there was an appropriation of $125,000 for this work, provided, however, that not more than $50,000 should be expended in any one year; and provided further, that the said survey shall be completed, as far as the field-work is concerned, by the end of the calendar year 1883. In June, 1883, $50,000 was again appropriated, for the continuance of the survey of the anthracite coal region of the State. A committee was also appointed to examine into the manner and efficiency of the work of the second geological survey, and report. The report is published in Part 5, Legislative Documents. (See above-named pamphlet laws in State Library; you will there find all information that can be obtained on this subject.) Total appropriations have amounted

to $445,000. The report of the committee, and the amount and continuance of appropriations, justify the opinion that the work has been regarded of practical benefit to the State.

MARYLAND.

In the State of Maryland geological surveys were made about the years 1837, 1838, 1841, and 1842. There was an appropriation of something over $10,000 about 1850 and 1864; not in one year, however, but from two to ten years. No late appropriations have been made.

The report further states that the geological survey of this State has been of great practical benefit to the people. Mines of bituminous coal have been opened and worked; also iron and copper mines, quarries of stone and marble, beds of shell marl and other marl used as fertilizers, and other valuable resources of the State, have been developed by this means.

The Secretary of the State in his remarks further states: "The resources of your State can never be known or fully developed without an extended survey by a competent geologist. Such has been the experience in our State."

VIRGINIA.

The State of Virginia has had only a partial survey. Appropriations have been made as follows: From 1835 to 1842, inclusive, the appropriations amounted to $19,500. No appropriations have been made since.

The work of this survey was undertaken in 1835 by Prof. W. B. Rogers, and prosecuted faithfully until the appropriations were cut off. Scientific men say that this work is of immense value, but the reports have never been published.

SOUTH CAROLINA.

South Carolina, between the years 1840 and 1850, had a partial survey made. No appropriation was then made, and no work since.

GEORGIA.

The geological survey of Georgia was organized in 1874, with an appropriation of $50,000, allowing an annual expenditure of $10,000. No additional appropriations had been made at the expiration of the fifth year, and the work was suspended.

Among the advantages of this survey, we find that attention was called and work commenced in a number of gold, copper, pyrites, mica, asbestos and graphite mines. Iron and coal areas before generally unknown.

Florida, Alabama, Mississippi, Louisiana, Tennessee and Texas have had no survey.

KENTUCKY.

The geological survey of Kentucky is now in progress. In 1837 there was an appropriation made of $10,000. Appropriations have since been made each year. The total appropriations amount to upwards of $154,000.

In mentioning the benefits the State has derived from this survey, the Secretary of State says: "Railways have been built, mines opened, etc. One factory at Frankfort — string hemp yarns for binding grain — was organized by the geological survey, and brings about $400 into the State each day. One company brought to the State through the instrumentality of the survey has already expended $1,000,000, and will expend much more."

OHIO.

A geological survey of the State of Ohio was made, and an appropriation was given in 1836. The appropriations since then have been made from time to time, as required, making the total appropriations amount to about $100,000. It has been quite beneficial to the State, as it has resulted in attracting to and developing the mineral resources of the State, and thus extending the coal and iron industries.

INDIANA.

There have been five different surveys of the State of Indiana, beginning about 1837, when $1,000 was appropriated. Appropriations have been made each year subsequent to 1860; total appropriations amounting to not less than $100,000; usual appropriations amounting to $5,000 or $8,000. It has been of great practical benefit to the people, as it has enhanced the taxable value of the State several millions; induced the building of one hundred miles of railway; suggested and created the erection and maintenance of blast-furnaces, rolling mills, nail mills, glass works, potteries, tile works, terra cotta works, and opened an annual export of crude materials to the amount of from $800,000 to $1,200,000 annually. It has especially created a market for our superior block coal, and gives direction to sale of such materials as stone and clay in new markets, to the amount of $100,000 to $200,000 annually. It has, by discovering road materials, increased gravel roads all over the State.

As important, or even more so, the State Geologist authoritatively, in open office, gives information to citizens or foreigners as to the minerals, soils, stone, lime, gravel, and other products of the State; its soils, forests, water, etc., being a constant advertising agent for daily exhibiting its interests.

ILLINOIS.

In 1851 there was an appropriation of $3,000 per annum for the purpose of carrying on a geological survey of the State of Illinois. After a term of two years this appropriation was increased to $5,000. The appropriations continued until 1873; the total amount of appropriations have been $110,000. The people have been greatly benefited by this survey; coal mining has been extended over nearly two-thirds of the State with profit, and manufacturing industries of various kinds have sprung up in consequence of an abundant supply of cheap fuel, bringing hither the raw materials of other States and enabling our people to successfully compete with Eastern manufacturers, in nearly every department of manufacturing. The zinc and iron ores of Wisconsin and Missouri are brought here in large quantities for smelting, and valuable deposits of fire clay, potters' clay, and mineral paints, together with building stone and marbles in extensive deposits, have been made known through the reports of the geological survey.

MICHIGAN.

In 1869 an annual appropriation of $8,000 was made for the purpose of a geological survey of the State of Michigan, to continue for so long a time as was necessary to complete the survey. The mining industries of this State, producing iron, copper and salt in immensely large quantities, do not seem to have originated as the result of previous geological investigation, but its progress was decidedly benefited by a close scientific investigation of the structure of the earth's crust covering our State, and mining operations became more systematic and less hazardous. Also, the knowledge of the general soil of the country in which we live, the building materials, etc., is of great importance to every inhabitant cultivating the soil or following any other vocation.

WISCONSIN.

A geological survey of the State of Wisconsin was made about the year 1853. In that year the first appropriation was made, of $1,375. Appropriations have been made each year since, amounting to $107,206. For references, see Prof. T. C. Chamberlain, State Geologist, Beloit, Wisconsin.

MISSOURI.

Missouri has had a partial geological survey, but it was discontinued in 1874. Reports show that it defined the boundaries of the coal fields, iron, lead, and zinc districts.

ARKANSAS.

A geological survey of Arkansas was made some twenty-five years ago.

Appropriations were made during the years of 1856 and 1857, amounting to about $4,800 per annum. Subsequently, appropriations were made in 1858 and 1859. The total amount of appropriations, as near as can be ascertained, are $10,800.

Although the survey was discontinued before it was completed, yet it has been the means of great benefit to the people.

This testimony is of great value to us, and enables us to arrive at a certainty in regard to the benefits derived from a geological survey. The most prosperous States in the Union to-day, are those where a thorough and systematic survey has been made, and this I believe to be without exception. Their growth and prosperity date from the time they commenced the work; every State has been amply remunerated for the outlay. It is of great importance to do it at once; the western part of our State is interested in the sinking of artesian wells, and its prosperity depends largely on the State taking hold of it and determining the result successfully. These wells cannot be sunk without a knowledge of the geological formations, and that part of the State cannot prosper without this is done. We believe everyone is in favor of the advancement and development of the State. If the Legislature wishes to advance its interests, nothing better could be done. A failure to take favorable action is simply hindering the progress of the State, and its development. Ohio, Indiana, Pennsylvania, Illinois, Kentucky, and others, report to us that a geological survey has done more for their States than anything else, and has resulted in finding coal, stone, minerals, &c., previously unknown, which has brought wealth and prosperity to their people.

Why anyone should oppose this, or be indifferent to a measure productive of so much good, is a mystery. We trust the people of Kansas will be alive to their interests and urge the Legislature to make the necessary appropriation.